1990 Insect Pest Management Guide

HOME, YARD, and GARDEN

MUCH HAS BEEN SAID ABOUT THE EFFECTS of pesticides, particularly insecticides, on the health and well-being of the American people. However, as you are also aware, insects can destroy your property or make your life uncomfortable. Destruction of crop residues, varietal selection, handpicking, fertilization, tree pruning, irrigation, screening, and other practices may reduce the number of insects with which you must contend. Occasionally, you can avoid or at least reduce the destruction caused by some pests without using an insecticide. For many insects, though, you must rely on an insecticide to provide the satisfactory management you want.

SAFE USE OF INSECTICIDES

By using insecticides and other pest-management tools carefully, you can enjoy reasonable freedom from insects without endangering yourself, your family, or your pets. You must recognize, however, that insecticides are designed to destroy one group of animals — insects — and can be harmful to other animals, including humans, if used without regard for normal safety precautions. Each insecticide user must handle, apply, and store insecticides safely in order to benefit from them without suffering from their dangers.

This publication lists certain insecticides with which to control insect pests of food, fabrics, structures, humans and animals, lawns, shrubs, trees, flowers, and vegetables. We have tried to suggest only the safest and most available materials. You may prefer to employ the services of a professional exterminator or custom applicator rather than to become involved in the selection and application of insecticides.

INSECTICIDES AND THEIR NAMES

The names used in the tables are the common, coined chemical names, not the trade names, and as such may not be familiar to you. For instance, the common name for *Cygon* is *dimethoate*. If there is no coined chemical name, the trade name is used but is capitalized. A table giving common, trade, and chemical names appears at the end of this circular.

CLASSIFICATION OF INSECTICIDES

Insecticides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. Only a few insecticides have been classified for restricted use at this time. No insecticides in this circular, except those listed for termites, have a restricted-use classification. A person wishing to use an insecticide classified for restricted use must be certified as a private or commercial applicator by the State of Illinois. Contact your county Extension adviser in agriculture for details about that program.

Requested label clearances for a few uses of some insecticides, carriers, and solvents are uncertain for 1990, since many requests have not yet been officially cleared. Consequently, labels may be cancelled, and the product removed from the market at any time. Anticipating this, we took a conservative attitude a few years ago and began modifying suggested uses in these annually revised guides. We have attempted to anticipate any further label changes in 1990, but occasionally there are still use cancellations. Check with your local county Extension adviser if you are not sure about the insecticide you plan to use. We will make announcements about label changes through the news media and newsletters in an attempt to keep you up to date.

Suggestions for the use of insecticides, effective from a practical standpoint, are based on available data. Many factors affect efficiency of control. Please report details of control failures to us.

In using the tables in this circular, *always read the footnotes* before using the insecticides. The footnotes list precautions and other pertinent information.

The suggestions given in this circular are subject to change without notification during the year.

SOURCES OF INFORMATION ON INSECTS

Fact sheets describing the life history, habits, and damage of specific insects and the nonchemical methods of control can be obtained from your county Extension adviser or by writing to Entomology Extension, 172 Natural Resources Building, 607 E. Peabody Drive, Champaign, Illinois 61820. These fact sheets are indicated by an NHE number in the tables.

INTEGRATED PEST MANAGEMENT FOR HOMEOWNERS

Pest control should be conducted in as safe a manner as possible. Reducing the use of insecticides and other pesticides through integrated pest management (IPM) is one way to accomplish this goal. The two main components of IPM are scouting for pests and utilization

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of a variety of pest population control methods. These include mechanical, biological, cultural, and chemical tools, use of resistant varieties, and prevention.

Scouting

Scouting is the process of finding the suspected pest, identifying it, and determining whether the pest is present in great enough numbers to justify control.

Finding the suspected pest. Indirect evidence may or may not indicate the presence of a pest. For instance:

— Holes in leaves may be caused by late frost damage, not by chewing insects.
— Piles of sawdust in the home may be construction debris sifting through cracks or the consequence of mouse activity rather than the trail of carpenter ants or other wood-destroying insects.

It is important to find the insects or other pests actually responsible for the damage observed. Do not assume guilt through association with the damage.

Identification. Once found, the suspect pest must be identified. In some situations an insect that is present in great numbers may not be the cause of damage.

— Lady beetle larvae and adults and other aphid-destroying insects are often found in large numbers in the midst of damage caused by aphids.
— Large numbers of ants in the lawn rarely damage the lawn and have little relationship to the number of ants that enter the home.

Identification is also important because some kinds of insects are more damaging than others. Once you know what kind of insect is present, you can better judge whether or not the potential damage justifies control measures. Knowing the identity of a pest also helps you learn about the insect's biology, enabling you to use other IPM tools to control the insect.

Pest population size. Knowing the number of pests present will help you estimate their impact and whether there is sufficient cause to spend time and money on control. Different numbers of pests may be damaging in different situations. For instance:

— One cockroach in a home is usually sufficient cause to start some kind of control measure, but a few in an outbuilding will probably not invade the home and would not need to be controlled.
— A small number of white grubs in a vegetable garden may cause heavy damage to root crops such as potatoes, carrots, and onions, but cause no yield loss to nonroot crops such as tomatoes, beans, and cabbage.

IPM Tools

Various control measures may be used on a pest population. Individual IPM tools may be more or less successful, depending on the situation and the biology of the pest. A good IPM program will usually combine two or more of these tools to control the pest.

Mechanical control. The use of mechanical devices to keep out or kill pests. These methods are frequently too labor intensive to be profitable commercially. However, in the relatively small areas of home landscapes, garden plots, and houses, mechanical devices may be very useful.

— Handpicking: removing insect pests by hand. Useful in controlling Colorado potato beetle adults and larvae, tomato hornworms, eastern tent caterpillars, fall webworms, and bagworm eggs.
— Barriers: keeping pests from reaching an area where damage can be caused. Tin cans and other barriers around young tomato plants can be used to keep out cutworms. Screening windows can keep out flies and other winged pests.
— Devices: using mechanical devices to control insects. For example, flyswatters to kill flies or other home-invading pests and red sticky balls to capture apple maggots.

Ultrasonic devices have not been shown to be effective in repelling insect pests.

Biological control. The use of other living organisms to control a pest. Naturally occurring predators, parasites, and diseases are very effective in reducing pest populations. When we increase the numbers of these natural enemies, we are practicing biological control.

— Augment the habitat to increase favorable conditions for the natural enemy so that it can become more numerous. Allow fallen leaves and other debris to accumulate in such areas as the base of shrubs to provide overwintering sites for lady beetles and other predatory insects. Leave vegetation that harbors mite predators beneath fruit trees to help control mite pests on the trees.
— Introduce more natural enemies into the area. For example, spray *Bacillus thuringiensis kurstaki* to control cabbage looper, imported cabbage worm, eastern tent caterpillar, and cankerworms; introduce minnows or other fish into ornamental pools to control mosquitos.

Cultural control. Controlling pests by changing the methods used to grow or maintain the plants, animals, or buildings that are attacked.

— Planting time: Early plantings of sweet corn will reduce damage by corn earworm. Planting zucchini squash early will allow more of the crop to be harvested before damage by squash vine borer occurs.
— Habitat changes: Good sanitation in the home will reduce cockroach numbers. Proper fertilization and growing conditions for shade trees help prevent borer infestations.

Chemical control. The use of chemical insecticides is an integral part of many IPM programs. Pesticides are commonly used for economical control of the pest population. Properly timed insecticide applications fre-

quently provide adequate control so that additional applications are not necessary.

Resistant varieties. Pest problems can be avoided or lessened by growing plant varieties or raising animals that are not heavily attacked by the pest in question.

— Plant birch varieties such as whitespire or heritage that are resistant to bronze birch borer.
— Butternut squash is more resistant to squash vine borer than are acorn or blue hubbard squashes. Zucchini squash appears to be the most susceptible summer squash variety.

Prevention. Pest problems can be avoided by keeping an insect pest out of the area where the crop is being grown. This is normally accomplished by governmental agencies with the assistance and cooperation of the public.

— Efforts made in keeping gypsy moth out of Illinois.
— Efforts made in keeping Mediterranean fruit flies and Africanized honey bees out of the U.S.A.

Another form of pest prevention is simply avoiding the food plants of particular pests. Careful selection of landscape or garden plants can prevent pest problems that might otherwise be difficult to control.

NAMES OF INSECTICIDES

Below is a list of the common names of insecticides used in the tables, followed by the commercial trade name and the chemical name. Some products may be available under a variety of trade names not listed below. Be sure to read the label. The label on the container always lists these products by the common name or chemical name.

Common name	Trade name	Chemical name
acephate	Orthene	O, S-dimethyl acetylphosphoramidothioate
Bacillus thuringiensis	Dipel, Thuricide, SOK-BT, Caterpillar Attack	
Bacillus thuringiensis 'israelensis'	Mosquito Attack	
Bacillus thuringiensis 'san diego'	M-One	
carbaryl	Sevin	1-naphthyl methylcarbamate
chlorpyrifos	Dursban	O, O-diethyl O-(3,5,6-trichloro-2-pyridyl) phosphorothioate
DEET	Off, Cutter's	N, N-diethyl-m-toluamide
diazinon	Spectracide	O, O-diethyl O-(2-isopropyl-4-methyl-6-pyrimidyl) phosphorothioate
dicofol	Kelthane	1,1-Bis(chlorophenyl)-2,2,2-trichloroethanol
dimethoate	Cygon	O, O-dimethyl S-(N-methyl carbamoyl methyl) phosphorodithioate
hydrazone	Combat	Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone (3-[4-(trifluoromethyl)phenyl]-1-(2-[4-trifluoromethyl)phenyl]-ethenyl)-2-propenylidene)hydrazone
hydroprene	Gencor	Ethyl-3,7,11-trimethyl dodeca-2,4 dienoate
malathion	Cythion	diethyl mercaptosuccinate, S-ester with O, O-dimethyl phosphorothioate
methoprene	Precor, Pharorid	Isopropyl-11-methoxy-3,7,11 trimethyl-2,4 dodecadienoate
naled	Dibrom	1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate
propoxur	Baygon	2-(1-methylethoxy) phenyl methylcarbamate
pyrethroids		
d-trans allethrin		allyl homolog of cinerin I
d-phenothrin	Sumithrin	3-phenoxybenzyl d-cis & trans 2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate
pyrethrin	Pyrenone	principally from plant species *Chrysanthemum cinariaefolium*
resmethrin	Chryson, SBP-1382	(5-benzyl-3-furyl) methyl 2,2 dimethyl-3-(2-methylprophenyl) cyclopropanecarboxylate
tetramethrin	Neo-Pynamin, Phthalthrin	(1-cyclohexene-1,2-dicarboximido)-methyl 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropanecarboxylate
tetrachlorvinphos	Rabon	2-chloro-1-(2,4,5,-trichlorophenyl) vinyl dimethyl phosphate

CONVERSION TABLE FOR SMALL QUANTITIES

1 level tablespoon = 3 level teaspoons	1 pint = 2 cups
1 fluid ounce = 2 tablespoons	1 quart = 2 pints or 32 fluid ounces
1 cup = 8 fluid ounces or 16 tablespoons	1 gallon = 4 quarts or 128 fluid ounces

VEGETABLE INSECTS

Insects	Crop	Insecticide	Suggestions
Aphids (NHE-47) Mites (NHE-58) Thrips	Most garden crops	malathion insecticidal soap	Apply on foliage to control the insects. Aphids and leafhoppers transmit plant diseases; early control is important. Mites web on the underside of leaves; apply insecticide to underside of leaves early before extensive webbing occurs.
Blister beetles (NHE-72) Cutworms (NHE-77) Flea beetles (NHE-36) Grasshoppers (NHE-74) Leafhoppers (NHE-22) Picnic beetles (NHE-40)	Most garden crops	carbaryl rotenone	For cutworms, attach collars of paper, aluminum foil, or metal at planting for small numbers of plants, or apply insecticide to base of plants at first sign of cutting. Control grasshoppers in garden borders when hoppers are small. For picnic beetles, pick and destroy overripe or damaged vegetables.
All cabbage worms (NHE-45)	Cabbage and related crops, salad crops, and leafy vegetables	*Bacillus thuringiensis*[1]	Presence of white butterflies signals start of infestation. Control worms when small. It is almost impossible to raise cole crops in Illinois without controlling these pests.
Hornworms (NHE-130) Fruitworms	Tomatoes	carbaryl *Bacillus thuringiensis*[1]	Handpicking usually provides satisfactory control of hornworms.
Earworms (NHE-33)	Tomatoes and sweet corn	carbaryl	Apply to late-maturing tomatoes 3 to 4 times at 5- to 10-day intervals from small-fruit stage. Apply at fresh-silk stage to early and late corn every 2 days 4 to 5 times.
Colorado potato beetles	Eggplant, potatoes, tomatoes	carbaryl rotenone *Bacillus thuringiensis* 'san diego'	Apply as needed. Insects usually present only in late May and June. Handpick larvae and adults off of plants.
Potato leafhoppers (NHE-22)	Potatoes, beans	carbaryl or malathion	Apply 3 to 4 times at weekly intervals starting in late May or early June. Late potatoes and beans require additional treatments. Most serious pest of potatoes and beans in Illinois.
Bean leaf beetles (NHE-67)	Beans	carbaryl rotenone	Leaves are riddled in early plantings. Apply once or twice as needed.
Mexican bean beetles	Beans	carbaryl rotenone	Except for southern Illinois, only a pest of late beans. Apply insecticide to underside of leaves.
Cucumber beetles (NHE-46)	Vine crops	carbaryl rotenone	Apply as soon as beetles appear in spring. When blossoming begins, apply insecticide late in the day so as not to interfere with pollination by bees. Cover plants with polyester row covers until blooming starts to protect plants without insecticides in the spring.
Squash vine borers (NHE-8)	Squash	carbaryl	Make weekly applications to crowns and runners when plants begin to vine. Apply late in day. Cover plants with polyester row covers until blooming starts to protect plants without insecticides in the spring.
Corn borers	Sweet corn	carbaryl	Apply 4 times every 3 days to whorl and ear zone of early corn when feeding appears on whorl leaves.
Soil insects (including grubs, wireworms, root maggots)	All crops	diazinon	Mix 6 fluid ounces of 25% diazinon emulsion in enough water to cover 1,000 sq. ft., usually 2 to 3 gallons. Rake into soil. Cover the soil with screening along rows of root maggot susceptible plants in the spring.

Days Between Application and Harvest

	Collards, kale, and other leafy crops	Beans	Lettuce	Cabbage and related crops	Sweet corn	Onions	Vine crops[2]	Tomatoes	Pumpkin	Eggplant	Peas	Potatoes
carbaryl	14	0	14	3	0	..	0	0	0	0	0	0
malathion	7	1	14	7	5	3	1	1	3	3	3	0
rotenone	1	1	1	1	1	..	1	1	..	1	1	1

Amount of Insecticide for Volume of Spray for Vegetable Insects

	1 gal.	6 gal.	100 gal.	Commercial dust
carbaryl 50% W.P.	2 tbl.	¾ cup	2 lb.	5%
malathion 50-57% E.C.	2 tsp.	4 tbl.	1 qt.	4%
rotenone 1% W.P.	6-8 tbl.	2¼-3 cups	6-8 lb.	1%

E.C. = emulsion concentrate; W.P. = wettable powder. An emulsion concentrate is a chemical pesticide dissolved in a solvent to which an emulsifier has been added. It can then be mixed with water to the desired strength before being used.

[1] No time limitations. Sold as Dipel, Thuricide, SOK-BT, and others. [2] Apply insecticides late in the day after blossoms have closed to avoid bee kill.

FLOWER INSECTS

Insect	Insecticide[1]	Dosage	Suggestions
Ants, soil-nesting wasps, and sowbugs (NHE-79, 93, 111) White grubs	diazinon 25% E.C.	1 cup per 1,000 sq. ft.	Drench into soil.
Aphids, mealybugs, spittlebugs, lacebugs, scales (NHE-7, 114)	malathion 50-57% E.C. acephate 15.6% E.C. insecticidal soap	2 tsp. per gal. water 4 tsp. per gal. water follow label directions	Spray foliage thoroughly. Repeat treatments may be needed.
Blister beetles (NHE-72)	carbaryl 50% W.P.	2 tbl. per gal. water	Spray foliage. Repeat treatments may be needed.
Cutworms (NHE-77)	diazinon 25% E.C. diazinon 5% granules	6 oz. per 2-3 gal. water 2½ lb. per 1,000 sq. ft.	Spray 1,000 sq. ft. soil at base of plants. Do not spray on plant foliage. Small numbers of plants can be protected with collars of paper, aluminum foil, or metal.
Earwigs (NHE-142)	carbaryl 50% W.P.	2 tbl. per gal. water	Spray foliage as needed. Do not spray blooms.
Grasshoppers (NHE-74)	carbaryl 50% W.P. malathion 50-57% E.C.	2 tbl. per gal. water 2 tsp. per gal. water	Spray foliage and also adjacent grassy or weedy areas.
Iris borer	dimethoate (Cygon 2E)	4 tsp. per gal. water	Apply when irises are in bloom, but not on blooms and make only one application. Add a small amount of liquid detergent to spray mix to improve coverage on leaves.
Leaf-feeding beetles Leaf-feeding caterpillars Plant bugs and leafhoppers	carbaryl 50% W.P. acephate 15.6% E.C.	2 tbl. per gal. water 4 tbl. per gal. water	Spray foliage. Repeat treatments if needed.
Slugs (NHE-84)	metaldehyde bait Mesurol 2% bait		Apply as a bait to soil. Remove old leaves, stalks, poles, boards, and other debris where slugs like to hide and lay eggs. Shallow dishes of stale beer sunk into the ground will attract and kill many slugs.
Springtails (NHE-70)	malathion 50-57% E.C. malathion 4% dust	2 tsp. per gal. water	Spray foliage and soil. Apply to base of plants.
Stalk borers (NHE-24)	Same as for leaf-feeding beetles		Spray foliage thoroughly and frequently.
Thrips	Same as for leaf-feeding beetles		Spray foliage carefully.
White flies (NHE-136)	pyrethrin 0.1% resmethrin insecticidal soap	aerosol spray follow label directions	Spray foliage thoroughly. Repeat in 5 days.

E.C. = emulsion concentrate; W.P. = wettable powder.

[1] Use only one insecticide from those listed. Do not use oil-base sprays on plants. Do not use malathion on African violets. Do not use carbaryl on Boston ivy. Do not use diazinon on ferns. Repeated use of carbaryl foliage sprays may cause mite or aphid infestations to increase and to become damaging. Do not use insecticides during full bloom. Do not use dimethoate on chrysanthemums.

Insects	Insecticide[1]	Suggestions[2]
Aphids (NHE-7)	acephate diazinon malathion insecticidal soap	Spray foliage thoroughly with force when aphids become numerous. Repeat as needed. Check for presence of lady beetles and other predators before spraying.
Bagworms (NHE-6)	acephate carbaryl malathion *Bacillus thuringiensis*[3]	Spray foliage thoroughly. Apply June 15. Later sprays are less effective. For late spraying, use *Bacillus thuringiensis.* Handpicking of bags in winter and early spring will reduce later infestations.
Borers Bronze birch (NHE-143)	dimethoate	Spray trunk and limbs thoroughly in late May and early June. Repeat in 3 weeks or apply 6-inch band of concentrate to trunk. Keep trees watered if dry during the summer. Keep trees healthy and vigorous.
Flatheaded apple tree Oak	chlorpyrifos	Spray trunk and/or limbs in mid-May and repeat 4 weeks later. Keep trees healthy and vigorous and avoid trunk wounds.
Ash (NHE-145) Lilac (NHE-145) Peach tree	chlorpyrifos	Spray trunk and limbs in mid-June and repeat 4 weeks later. Keep the tree healthy and vigorous and avoid wounds or injury to the trunk. Prune out large lilac trunks.
Cankerworms (NHE-95)	acephate carbaryl malathion *Bacillus thuringiensis*[3]	Spray foliage when feeding or worms are first noticed in spring.
Eastern tent caterpillars	Same as for cankerworms	Spray when nests are first noticed. Remove nests and destroy.
Elm leaf beetles (NHE-82)	acephate *Bacillus thuringiensis* 'san diego' carbaryl	Spray as soon as damage is noticed.
European pine shoot moths and Nantucket pine moths (NHE-83)	dimethoate	Spray ends of branches thoroughly in late June for European species and in mid-May for Nantucket species.
Fall webworms	acephate carbaryl malathion *Bacillus thuringiensis*[3]	Spray when first webs appear; clip off and destroy infested branches or burn out webs.
Galls (NHE-80, 81) Elm cockscomb Hickory Maple bladder	diazinon malathion	Spray foliage thoroughly when buds are unfolding. Sprays after galls form on leaves are ineffective. Galls rarely harm the tree.
Hackberry blister	acephate diazinon malathion	Spray foliage thoroughly in late May. Kills psyllids in galls. Sprays after galls form on leaves are ineffective. Galls are not harmful to the tree.
Cooley spruce Eastern spruce	diazinon malathion	Apply in late September or October or early spring just after bud break.
Green-striped mapleworms	Same as for cankerworms	Spray as soon as damage is noticed.
Leaf miners Boxwood Hawthorn Oak	diazinon malathion acephate	Spray foliage thoroughly when miners first appear. Repeat treatment in 10 to 12 days. Use acephate only on oak. Leaf miners usually do not harm the tree.
Birch Holly	dimethoate	Repeat treatment in 3 weeks.
Mealybugs	acephate malathion insecticidal soap	Spray foliage thoroughly and with force. Repeat in 2 weeks.
Mimosa webworms (NHE-109)	acephate malathion *Bacillus thuringiensis*[3]	Spray foliage thoroughly when first nests appear (June, July). A repeat treatment for second-generation larval feeding may be needed (August).
Oak kermes	malathion	Spray foliage thoroughly about July 1 to kill the crawlers.
Periodical cicadas (NHE-113)	carbaryl	Spray all branches thoroughly when adults appear. Repeat in 7 to 10 days. Protect very young trees (<2″ dia.) with screening around the top and trunk.
Sawflies	carbaryl	Spray as soon as worms or damage is evident. Handpicking is also effective.
Scales (NHE-100, 114, 146)	diazinon malathion acephate	Spray foliage thoroughly in early April for *Fletcher* and *European elm scale;* in late May for *pine needle* and *sweet gum scale;* in early June for *scurfy, oystershell,* and *euonymous scales;* in early July for *cottony maple, Juniper,* and *dogwood scales;* in mid-July for *spruce bud scale;* and again in August for *oystershell scale.*

[1] Use only one insecticide of those listed. [2] Treatment dates listed are for central Illinois. In southern Illinois, apply 2 weeks earlier; in northern Illinois, 2 weeks later. [3] Trade names: Dipel, Thuricide, SOK-BT, and others.

TREE AND SHRUB INSECTS (continued)

Insects	Insecticide[1]	Suggestions[2]
Cottony maple (NHE-144), Putnam, San Jose, Tulip tree	dormant oil diluted according to label	Apply when plants are still dormant in late winter. Do not use on evergreens. For tulip tree scale, a malathion spray in late September or in early spring is also effective.
Sycamore lace bugs Plant bugs	acephate carbaryl malathion	Spray when nymphs appear, usually in late May.
Thrips	Same as for aphids	Mainly on privet. Spray foliage thoroughly.
Yellow-necked caterpillars	acephate carbaryl malathion *Bacillus thuringiensis*	Spray foliage when worms are small (July).
Zimmerman pine moths (NHE-83)	chlorpyriphos dimethoate	Spray trunk and branches in mid-April for young larvae and/or mid-August for adults and young larvae.

[1] Use only one insecticide from those listed. [2] Treatment dates listed are for central Illinois. In southern Illinois, apply 2 weeks earlier; in northern Illinois, 2 weeks later. [3] Trade names: Dipel, Thuricide, SOK-BT, and others.

Amount of Insecticide Needed for Volume of Spray for Tree and Shrub Insects

	1 gal.	6 gal.	100 gal.		1 gal.	6 gal.	100 gal.
acephate (Orthene) 15.6% E.C.[1]	4 tsp.	1 cup	2 qt.	diazinon 25% E.C.[4]	2 tsp.	4 tbl.	1 qt.
carbaryl (Sevin) 50% W.P.[2]	2 tbl.	¾ cup	2 lb.	dimethoate (Cygon 2E)[3]	2 tsp.	4 tbl.	1 qt.
chlorpyrifos (Dursban 2E)	2 tsp.	4 tbl.	1 qt.	malathion 50-57% E.C.[5]	2 tsp.	4 tbl.	1 qt.

E or E.C. = emulsion concentrate; W.P. = wettable powder.

[1] Do not use on flowering crab, sugar maple, redbud, American elm, Lombardy poplar, or cottonwood. [2] Do not use on Boston ivy. [3] Do not use on chrysanthemums. [4] Do not use on ferns or hibiscus. [5] Do not use on canaert red cedar.

LAWN INSECTS

Insects	Insecticide[1]	Dosage per 1,000 sq. ft.[2]	Suggestions
White grubs (NHE-104, 147)	diazinon 25% E.C. 5% G.	1 cup 2½ lb.	Apply as spray or granules to small area and then water in thoroughly before treating another small area. Grub damage will usually occur in late August and in September.
Ants (NHE-111) Cicada killer and other soil-nesting wasps (NHE-79, 150)	diazinon 25% E.C. 5% G. chlorpyrifos 5 or 6% E.C.	¾ cup 2 lb. 1 cup	Apply as spray or granules and water in thoroughly. For individual nests pour 1% diazinon in nest and cover with soil.
Sod webworms (NHE-115)	carbaryl 50% W.P. diazinon 25% E.C. 5% G. chlorpyrifos 5 or 6% E.C.	½ lb. ¾ cup 2 lb. 8 fl. oz. (1 cup)	As sprays, use at least 2.5 gal. of water per 1,000 sq. ft. Do not water for 72 hours after treatment. As granules, apply from fertilizer spreader. Webworms usually damage lawns in late July and in August.
Millipedes and sowbugs (NHE-93)	carbaryl 50% W.P. diazinon 25% E.C. chlorpyrifos 5 or 6% E.C.	½ lb. ¾ cup 1 cup	Spray around home where millipedes or sowbugs are crawling. If numerous, treat entire lawn.
Armyworms Cutworms	carbaryl 50% W.P. chlorpyrifos 5 or 6% E.C.	2 oz. 1 cup	Apply as sprays or granules. Use 5 to 10 gal. of water per 1,000 sq. ft.
Chinch bugs	chlorpyrifos 5 or 6% E.C. diazinon 25% E.C. 5% G.	1 cup ¾ cup 2 lb.	Spray infested areas where chinch bugs are present.
Aphids (NHE-148)	acephate 15.6% E.C.	4½ fl. oz.	Spray grass thoroughly.
Slugs (NHE-84)	Mesurol 2% bait		Apply where slugs are numerous. Scatter in grass. For use only in flower gardens and shrubbery beds.
Bluegrass billbugs	chlorpyrifos 5 or 6% E.C.	1 to 2 cups	Apply as a spray in spring to lawn damaged in previous year. Drench at high rate in July if damage is observed.

E.C. = emulsion concentrate; W.P. = wettable powder; G. = granules.

[1] Use only one insecticide from those listed. [2] To determine lawn size in square feet, multiply length times width of lawn and subtract non-lawn areas including house, driveway, garden, etc. Do not allow people or pets on the lawn until the spray has dried.

Insects	Insecticide[1]	Suggestions for control
Ants (NHE-111) Carpenter ants (NHE-10)	*Outdoors:* diazinon 25% E.C. *Indoors:* chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U. hydrazone baits propoxur baits boric acid R.T.U.	**Chemical.** Use diazinon to spray completely around outside foundation and the adjacent 1 ft. of soil. Apply an R.T.U. spray to baseboards, cracks, and door thresholds. Apply boric acid in out-of-reach areas only. **Nonchemical.** Keep foods in tightly sealed containers or in the refrigerator. Most ants prefer sweets and fats. Practice good sanitation. Avoid leaving dirty dishes or other food particles where they are accessible to ants. Caulk cracks and crevices in house foundation.
Ants, Pharaoh	methoprene baits boric acid baits	**Chemical.** *Indoors:* Place baits near ant food and water sources and in other areas where ants are found. Treat for several weeks, replacing bait as it becomes dry. **Nonchemical.** Follow suggestions above for other ants. Apply petroleum jelly or double-sided tape to furniture legs to keep ants off of furniture.
Boxelder bugs (NHE-9)	diazinon 25% E.C. carbaryl 50% W.P. insecticidal soap	**Chemical.** Spray boxelder bugs on tree trunks, foundation walls (diazinon and insecticidal soap), under eaves, and other areas where they gather. Use carbaryl on foliage where beetles are feeding. **Nonchemical.** Keep screens, and other openings in good repair. Caulk all seams around windows and doors. Indoors remove the bugs by vacuuming.
Carpet beetles, clothes moths (NHE-87)	chlorpyrifos R.T.U. diazinon R.T.U.	**Chemical.** Spray storage areas, edges of carpeting, baseboards, cracks and crevices. **Nonchemical.** Destroy all badly infested materials. If insulation is of plant or animal origin remove it from the structure. Check for any dead animal or bird carcasses that may be in wall voids, chimneys, or fireplace areas. Keep accumulation of lint to a minimum and vacuum thoroughly in areas where hair and other natural fibers gather. Remove all bird, insect, and rodent nests in the fall before cool weather. Place cleaned or washed woolens in insect-free chests that are tightly sealed or in plastic bags. Dry cleaning and laundering kills these pests.
Carpenter bees	carbaryl 5% dust diazinon R.T.U.	**Chemical.** Dust and spray entrances to nest with insecticide. Do not plug entrance. **Nonchemical.** In the fall, fill the holes and paint or varnish the entire wood surface.
Centipedes, millipedes, sowbugs (NHE-93)	*Outdoors:* diazinon 25% E.C. *Indoors:* chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U.	**Chemical.** Apply diazinon as an outside foundation spray. If millipedes are abundant, treat entire lawn according to label. *Indoors:* Use R.T.U. spray according to label. **Nonchemical.** Correct situations where moist habitats occur such as crawl spaces, poorly drained areas, and piles of trash, mulch, or compost. Remove indoors by vacuuming.
Chiggers (NHE-127)	diazinon 25% E.C. DEET R.T.U.	**Chemical.** Treat lawns, roadsides, and areas not mowed. For personal protection, a repellent such as DEET will prevent attack. **Nonchemical.** Eliminate or mow breeding sites, especially briars, weeds, and other thick vegetation where there is an abundance of moisture and shade. Wear protective clothing such as a long-sleeved shirt and trousers, shoes, and socks. Tuck pant legs into boots or socks. Avoid sitting on the ground either in the lawn or brushy areas. Take a warm soapy shower or bath immediately after returning from any infested areas.
Clover mites (NHE-2)	pyrethroid R.T.U. dicofol 35% W.P.	**Chemical.** Apply dicofol spray to outside foundation and adjacent 1 ft. of soil. *Indoors:* Spray with pyrethroid. **Nonchemical.** Eliminate grass and other vegetation in a 1 ft. band all the way around the house. Also make sure window and door seams are properly caulked and sealed to prevent entry by the mites. *Indoors:* Mites can be removed by vacuuming.

E.C. = emulsion concentrate; W.P. = wettable powder; R.T.U. = ready to use; G. = granules.

[1] Whenever possible, purchase specially prepared, ready-to-use forms of insecticides for indoor use. Use only one insecticide from those listed. When preparing a quantity of 1 gallon or more of a spray, follow the mixing directions on the pesticide label.

Insects	Insecticide[1]	Suggestions for control
Cluster flies (NHE-1)	pyrethroid R.T.U.	**Chemical.** Fog lightly in rooms with pyrethroid. Repeat spray as needed. **Nonchemical.** Seal cracks and openings around windows, eaves and siding. Use fly screen over air intake vents or air conditioning systems. Seal off attic openings with screen or caulking. *Indoors:* Remove flies by vacuuming.
Cockroaches German (NHE-3) Brown-banded (NHE-4) American and Oriental (NHE-5)	chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U. boric acid R.T.U. hydroprene R.T.U. hydrazone bait propoxur bait	**Chemical.** Spray roach runways and hiding places. Treat under sink, refrigerator, cabinets, on baseboards, etc. Treatment throughout home may be needed to control brown-banded roaches. May be supplemented with boric acid applied into out-of-sight and out-of-reach voids under cabinets and appliances. **Nonchemical.** Practice proper sanitation by keeping food properly sealed or stored in the refrigerator. Keep trash covered. Do not allow dirty dishes to accumulate. Clean frequently under refrigerators and stoves where food particles may accumulate. Eliminate hiding places such as piles of newspapers, boxes and papers. Caulk cracks and crevices. Do not leave pet food out overnight.
Crickets (NHE-137) Field House Camel	*Outdoors:* diazinon 25% E.C. *Indoors:* chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U. propoxur bait	**Chemical.** Use diazinon to spray completely around outside foundation and the adjacent 1 ft. of soil. Apply an R.T.U. spray to baseboards, cracks, and door thresholds. **Nonchemical.** Cracks and crevices around windows, doors, and in the foundation should be properly sealed and caulked. *Indoors:* Remove crickets by vacuuming. House lights attract both field and house crickets. Keep garbage cans clean and empty frequently. Keep firewood at least 1-2 feet away from the foundation. Apply a 6-inch band of ashes around the wood pile. Eliminate sources of moisture by fixing leaky pipes and modifying damp areas.
Drain flies (NHE-91)	pyrethroid R.T.U.	**Chemical.** Use chemicals only after solving sanitation problems. Pour boiling water or rubbing alcohol into overflow drain to eliminate maggots. **Nonchemical.** Practice proper sanitation. Clean out overflow drains, drain traps, and basement drains. Keep screens in good repair.
Earwigs (NHE-142)	*Outdoors:* diazinon 25% E.C. *Indoors:* chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U. propoxur bait	**Chemical.** Apply diazinon as an outside foundation spray. *Indoors:* Use R.T.U. spray according to label. **Nonchemical.** Remove unessential plant debris, mulch, and boards from around buildings. Establish a zone of bare concrete or soil which will dry out. *Indoors:* Remove by vacuuming. Caulk cracks and crevices around windows, doors, and in the foundation.
Elm leaf beetles (NHE-82)	carbaryl 50% W.P. *Bacillus thuringiensis* 'san diego'	**Chemical.** Spray nearby Chinese elm trees during the summer to reduce the number of beetles that come into homes in the fall. **Nonchemical.** Seal cracks and crevices around windows and other openings to prevent entry. *Indoors:* Remove by vacuuming.
Fleas (NHE-107)	naled carbaryl 5% dust methoprene R.T.U. pyrethroid R.T.U.	**Chemical.** Replace flea collars on pets about every 3 months. Some pets are allergic. Dust pets directly as needed. Dust areas inside and outside the home where pets rest. For infestations in the home, spray edges of carpets and rugs, and floors where fleas are observed. Follow label directions. Vacuum rugs and upholstered furniture thoroughly approximately 30 minutes after spraying.

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HOUSEHOLD INSECTS (continued)

Insects	Insecticide[1]	Suggestions for control
Fleas (cont.)	diazinon 25%E.C.	**Chemical.** Apply to lawn. **Nonchemical.** Frequently launder pet bedding and rugs where pets frequent with hot soapy water. Vacuum thoroughly to remove lint and dust around baseboards and cracks where flea eggs and larvae accumulate. Eliminate vegetation that will serve as a harborage for the native mammal population (carriers of fleas). Prevent pets from resting under the house and exclude mammals by screening attic and eave entrances. Thoroughly clean furniture in areas pets tend to frequent.
Flies (NHE-16) Houseflies Gnats, Midges	*Outdoors:* malathion 50-57% E.C. *Indoors:* pyrethroid R.T.U.	**Chemical.** Use malathion to spray around garbage cans and other resting sites. Apply fine mist or fog of pyrethroid. **Nonchemical.** Proper sanitation is important. Dispose of refuse frequently and prevent the accumulation of rotting or decaying vegetation. Keep screens in good repair. Fly strips and fly swatters can also be effective.
Honey bees (NHE-141)	carbaryl 5% dust diazinon R.T.U. pyrethroid R.T.U.	**Chemical.** Drill holes through siding to inject insecticide, if necessary. Remove nests and honey and destroy them. Treat nests at dusk or dawn. **Nonchemical.** Caulk cracks and crevices during the winter or early spring to prevent nest building. Seal off attic openings, air intake vents, and air conditioning systems with fly screen.
Lice (NHE-105) Human Head Crab Body	Kwell 1% shampoo pyrethrin R.T.U.	**Chemical.** Dust lightly over body hair. Repeat in 2 weeks if needed. Do not get in eyes. Consult a physician. **Nonchemical.** Practice proper personal hygiene. Avoid using other individuals' combs, hats, towels, or hair brushes. Bedding and clothing should be changed and washed frequently. Sanitation of locker rooms, and proper laundering will help reduce the incidence of lice. Crab louse is usually transmitted through intimate sexual contact.
Mites, Human Human scabies Human itch mite (NHE-135)	Kwell 1% lotion available only by a physician's prescription pyrethrin R.T.U.	**Chemical.** Consult a physician. **Nonchemical.** Consult a physician.
Mosquitoes (NHE-94,132)	*Outdoors:* malathion 50-57% E.C. pyrethroid fogger *Bacillus thuringiensis* 'israelensis' *Indoors:* pyrethroid R.T.U.	**Chemical.** Spray tall grass, around doorways, and other resting sites. Use a repellent like DEET when entering mosquito-infested areas. Apply fine mist or fog of pyrethroid. **Nonchemical.** Keep screens in good repair. Flues and chimneys should be covered during the summer months. Eliminate resting places such as tall grass, weeds, shrubbery, and vines from around the home. Eliminate rain-water-collecting items such as old tires, pans, cans, and buckets. Weekly, drain plastic swimming pools and bird baths. Provide for proper water drainage around the foundation of the home. When visiting mosquito-infested areas, wear protective clothing to prevent bites. If small garden ponds are present use Top minnows *Gambusia* sp. or *Bacillus thuringiensis* 'israelensis'. *"Bug zappers" and ultrasonic devices have not proven to be extremely effective in controlling mosquitoes and other noxious flying insects.*
Pantry and Cereal Pests (NHE-11) Grain beetles Indian meal moth Flour beetles	diazinon R.T.U. propoxur R.T.U. chlorpyrifos R.T.U. pyrethroid R.T.U.	**Chemical.** Force spray into cracks and crevices; allow to dry; cover shelves with clean, fresh paper. Do not contaminate food or utensils with insecticide. **Nonchemical.** Discard infested packages. Thoroughly clean and vacuum food cabinets and shelves. Keep dry food in tightly sealed containers. Keeping nonhuman food at 32°F for 3-4 days will kill eggs and larvae.
Powder-post beetles (NHE-85)	chlorpyrifos 42% E.C.	**Chemical.** Use chlorpyrifos to paint or spray infested unfinished wood. Follow label directions. **Nonchemical.** Avoid buying furniture or wood products that have not been stained, varnished or properly dried. Properly paint or varnish new wood items to seal pores and to prevent egg laying.

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Insects	Insecticide[1]	Suggestions for control
Silverfish (NHE-86)	diazinon R.T.U. propoxur R.T.U. chlorpyrifos R.T.U. boric acid R.T.U.	**Chemical.** Spray runways, baseboards, closets, and places where pipes go through the walls. Repeat treatments in 2 weeks if needed. Apply boric acid in out-of-reach areas only. **Nonchemical.** Alter the physical environment of the infested area by reducing the humidity. Reduce harborage sites by caulking cracks and crevices. Eliminate their food source by storing books, papers, and linens in tightly sealed containers or cabinets.
Spiders (NHE-17, 116)	*Outdoors:* diazinon 25% E.C. *Indoors:* chlorpyrifos R.T.U. diazinon R.T.U. propoxur R.T.U.	**Chemical.** Use diazinon to spray completely around outside foundation and the adjacent 1 ft. of soil. Apply R.T.U. spray to baseboards, cracks, and door thresholds. *Do not use diazinon E.C. inside.* **Nonchemical.** Keep screens and other openings in good repair. Caulk all seams around windows and doors. Spiders are considered beneficial as they are predators of insects and other small animals. *Indoors:* Remove by simply vacuuming.
Springtails (NHE-70)	*Outdoors:* diazinon 25% E.C.	**Chemical.** *Outdoors:* Spray soil next to the house, especially grassy moist areas. **Nonchemical.** Eliminate moist areas around the home where mulch and rotting vegetation are present. Keep outside light use to a minimum. Keep screens and doors in good repair. Allow potting soil of houseplants to dry out between waterings.
Swimming pool insects (NHE-103)	Do *not* add insecticides to pool water	**Chemical.** None. **Nonchemical.** Keep outside light to a minimum. Maintain proper chlorine balance in the pool. Cover pool when not in use.
Termites (NHE-57)	chlorpyrifos 42% E.C. (Dursban T.C.) fenvalerate 24.5% E.C. (Tribute) permethrin (Dragnet 36.8% E.C.) (Torpedo 25.6% E.C.) cypermethrin 25.3% E.C. (Demon T.C.)	**Chemical.** Fenvalerate, cypermethrin, and permethrin are restricted-use pesticides. Control by pest control operator (exterminator) recommended. **Nonchemical.** Remove termite tubes connecting the soil to wood sources. Eliminate wood-to-soil contacts. Ventilate damp areas such as crawl spaces for proper drying. Use treated wood when landscaping or constructing outside structures. Cedar and redwood are somewhat resistant; termites prefer hardwoods.
Ticks (NHE-56) Brown dog tick American dog tick Deer tick Lone star tick	tetrachlorvinphos 50% W.P. malathion 50-57% E.C. carbaryl 50% W.P. carbaryl 5% dust tetrachlorvinphos 3% dust DEET R.T.U.	**Chemical.** Apply spray to lawns, fencerows, roadsides, and areas not regularly mowed. Dust pets directly as needed, according to label instructions. Dust baseboards, cracks, and crevices around pet bedding. Use a repellent like DEET when entering tick-infested areas. **Nonchemical.** Keep vegetation, weeds and brush, mowed and clean. Avoid areas where ticks are known to be present. Wear long-sleeved shirt and trousers when visiting infested areas, tuck pant-legs into socks. Check for ticks on skin or clothing every few hours. Vacuum baseboards and other cracks and crevices thoroughly to destroy eggs and immatures.
Wasps (NHE-141) Hornets Yellowjackets	carbaryl 5% dust diazinon R.T.U. pyrethroid R.T.U.	**Chemical.** For nests belowground, apply diazinon according to label and seal opening with soil. Spray aboveground wasp and hornet nests in partitions with carbaryl. Drill holes through siding to inject insecticide, if necessary. Remove nests and destroy them. Treat nests at dusk or dawn. **Nonchemical.** Keep garbage cleaned up and properly covered. Avoid indiscriminate killing of wasps, hornets, and yellowjackets, as they are considered beneficial. If picnicking, keep food properly covered or sealed. Avoid areas where yellowjackets are prevalent. Keep overripe fruit and vegetables cleaned up and away from human activity. Caulk cracks and crevices during the winter or early spring to prevent yellowjacket nests but do not caulk opening of active nest.

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FOR YOUR PROTECTION

1. Store insecticides out of reach of children, irresponsible persons, or animals; store preferably in a locked cabinet.

2. If you use a bait around or in the home, place it after the children have retired and pick it up in the morning before they get up. Furthermore, place it out of their reach. At present we do not encourage the use of baits for insect control.

3. Avoid breathing insecticide sprays and dusts over an extended period. This is particularly true in enclosed areas such as crawl spaces, closets, basements, and attics.

4. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.

5. Wear rubber gloves when handling insecticide concentrates.

6. Do not smoke while handling or using insecticides.

7. Leave unused insecticides in their original containers with the labels on them and in locked cabinets.

8. Triple-rinse empty pesticide containers. Wrap each container in several layers of paper. Dispose of the containers one at a time through the municipal solid-waste-disposal system.

9. Do not leave puddles of spray on impervious surfaces.

10. Do not apply insecticides to fish ponds.

11. Do not apply insecticides near dug wells or cisterns.

12. Observe all precautions listed by the manufacturer on the label.

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